

ABSTRACT OF THE DISCLOSURE

A new photopolymerizable material allows single-step, fast recording of volume holograms with properties that can be electrically controlled. Polymer-dispersed liquid
5 crystals (PDLCs) in accordance with the invention preferably comprise a homogeneous mixture of a nematic liquid crystal and a multifunctional pentaacrylate monomer, in combination with photoinitiator, coinitiator and cross-linking agent. Optionally, a surfactant such as octanoic acid may also be
10 added. The PDLC material is exposed to coherent light to produce an interference pattern inside the material. Photopolymerization of the new PDLC material produces a hologram of clearly separated liquid crystal domains and cured polymer domains. Volume transmission gratings made
15 with the new PDLC material can be electrically switched between nearly 100% diffraction efficiency and nearly 0% diffraction efficiency. By increasing the frequency of the switching voltage, switching voltages in the range of 50 Vrms can be achieved. The optional use of surfactant allows low
20 switching voltages at lower frequencies than without surfactant. In an alternative embodiment, a PDLC material in accordance with the invention can be utilized to form reflection gratings, including switchable reflection gratings. In still further embodiments, a PDLC material in
25 accordance with the invention can be used to form switchable subwavelength gratings. By further processing, static transmission reflection, and subwavelength PDLC materials can be formed.

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